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H1T T11 T12
H2E EHE
U1S S1248 S2316

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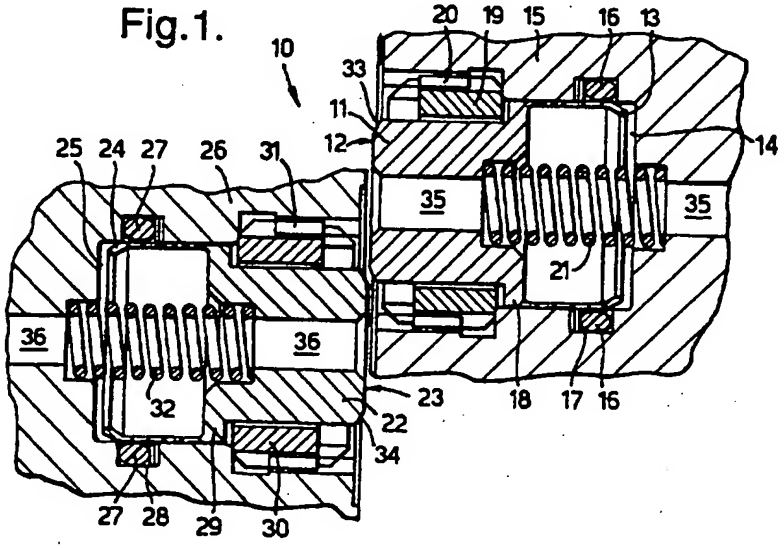
GB 2132728 A

(58) Field of Search
UK CL (Edition P) F2G G23 G4F G4K G4Z , H1T , H2E EHE
INT CL^6 F16L 17/00 21/00 25/00 37/00 37/56 39/00 , H01F 38/14 , H01R

(54) Two part connector

(57) The connector (10) comprises a pair of support members (15, 26) defining respective bores (14, 25) supporting respective pistons (11, 22) for movement along respective parallel axes. Pre-loaded springs (21, 32) react between the support members (15, 26) and the pistons (11, 22) to bias the pistons (11, 22) axially outwardly as far as respective stops so that their mating surfaces (12, 23) project slightly past each other. Movement of the support members (15, 26), in a direction at right angles to the two axes, causes the mating surfaces (12, 23) to wipe each other until the two axes are aligned, and a fluid connection (35, 36) admits pressurised fluid behind each piston (11, 22) to press the mating surfaces (12, 23) together when the two axes are aligned. In this manner the mating surfaces (12, 23) shear across each other, thereby wiping off any contaminants as their axes are aligned, and the pistons (11, 22) ensure that the cleaned mating surfaces (12, 23) are held tightly together to prevent either the ingress of contaminants between them, or the leakage of any fluid if the two part connector (10) is used to interconnect fluid passage ways. Alternatively the two part connector (10) may be an electrical or optical connector.

Fig.1.



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At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy

Fig.1.

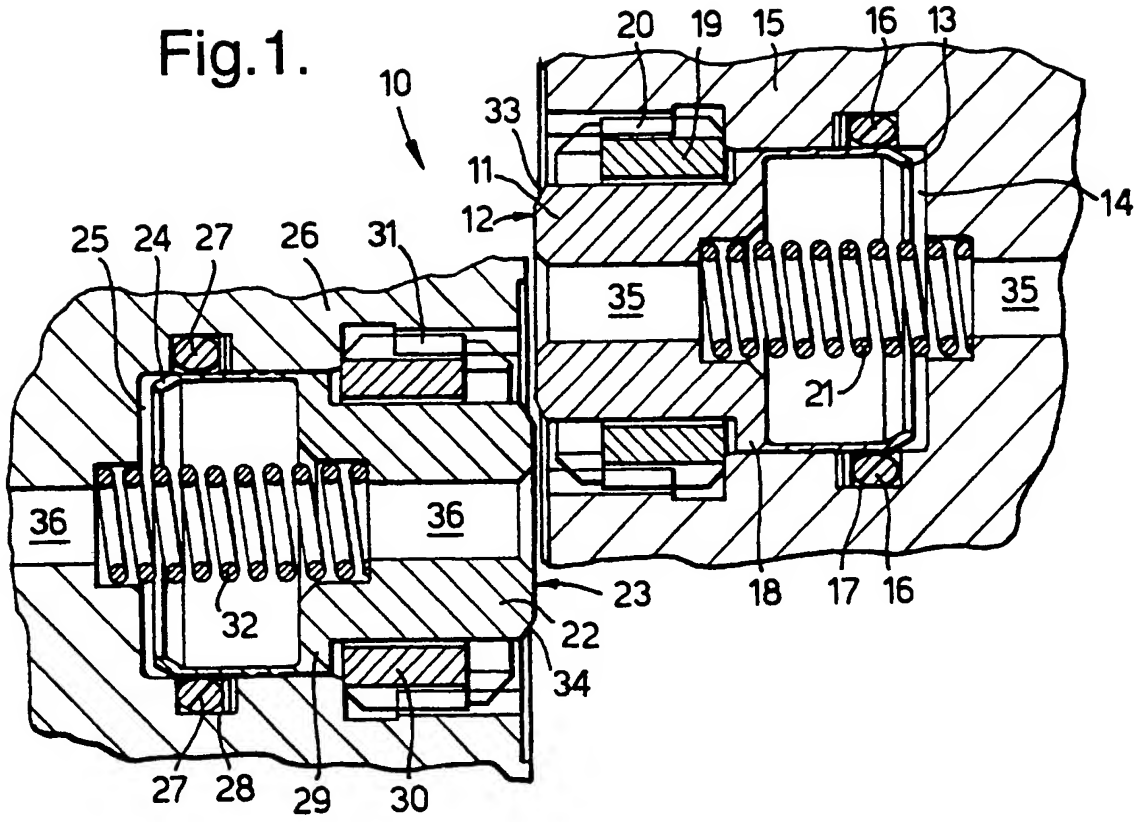
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Fig.2.

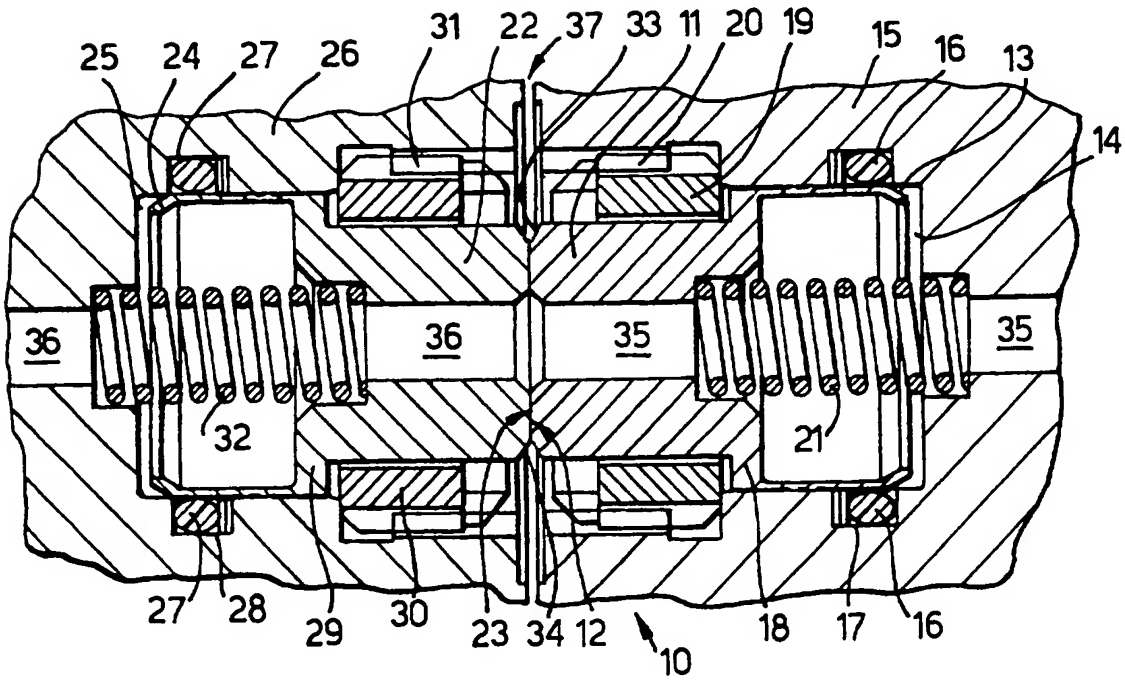
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Fig.3.

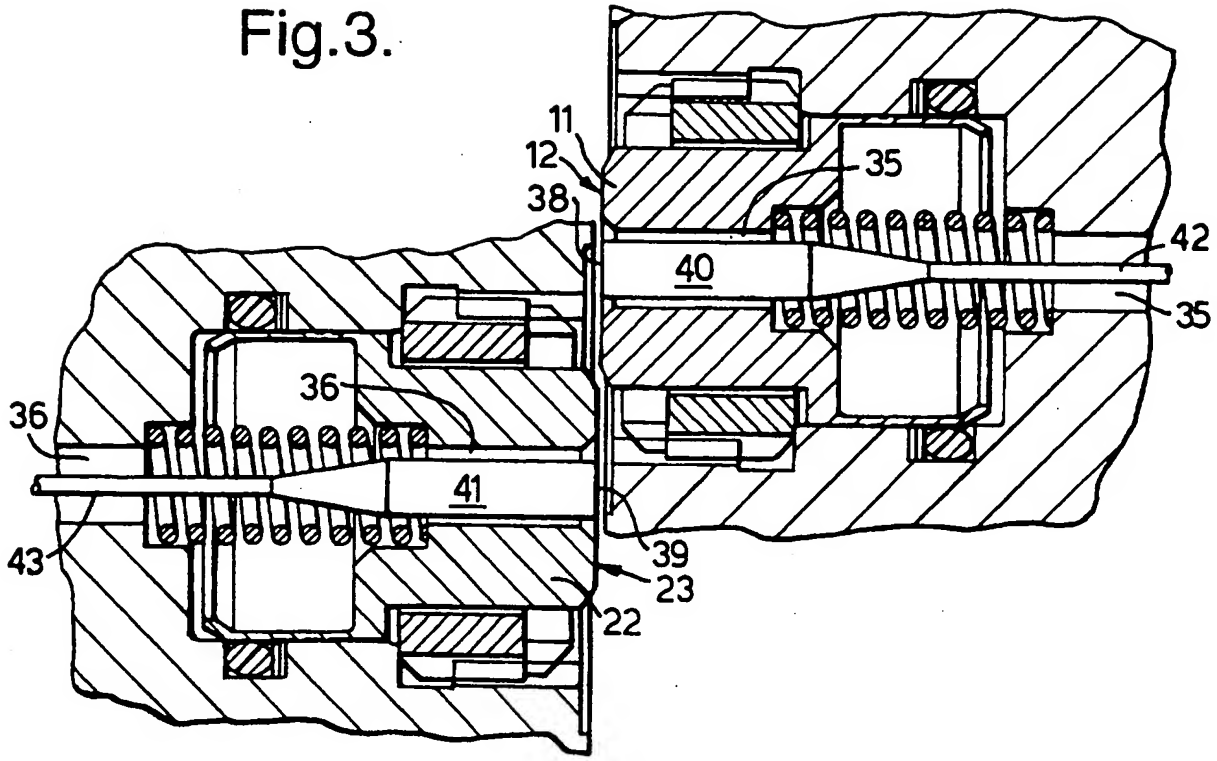
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Fig.4.

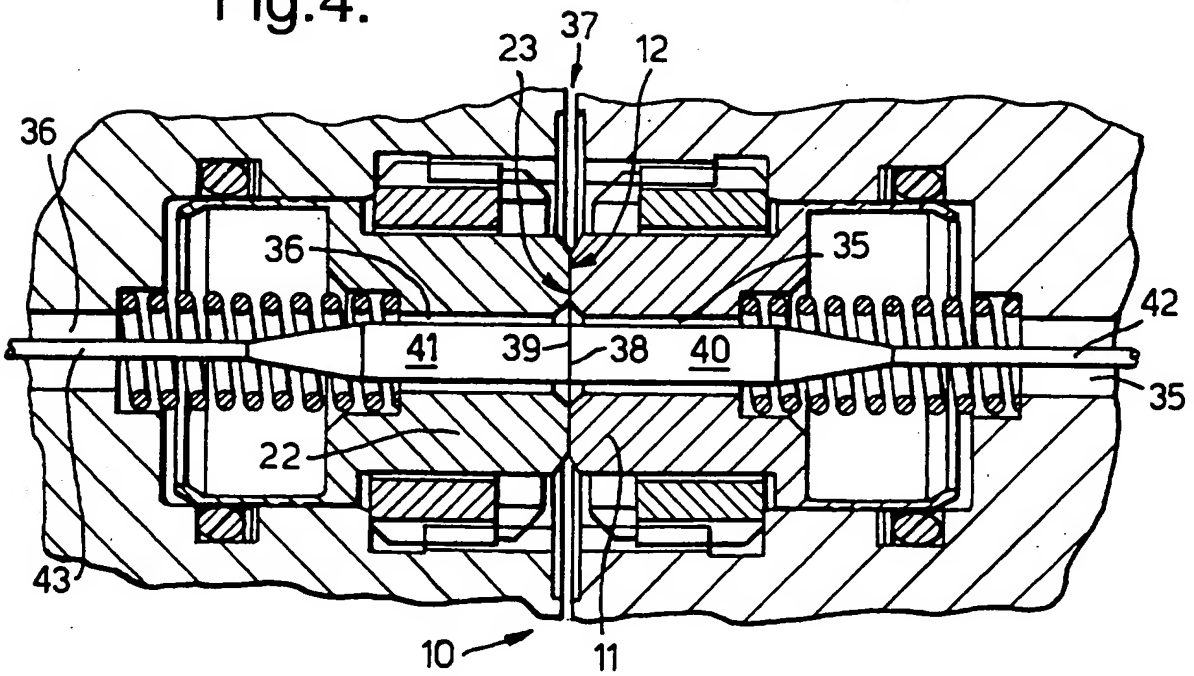
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Fig.5.

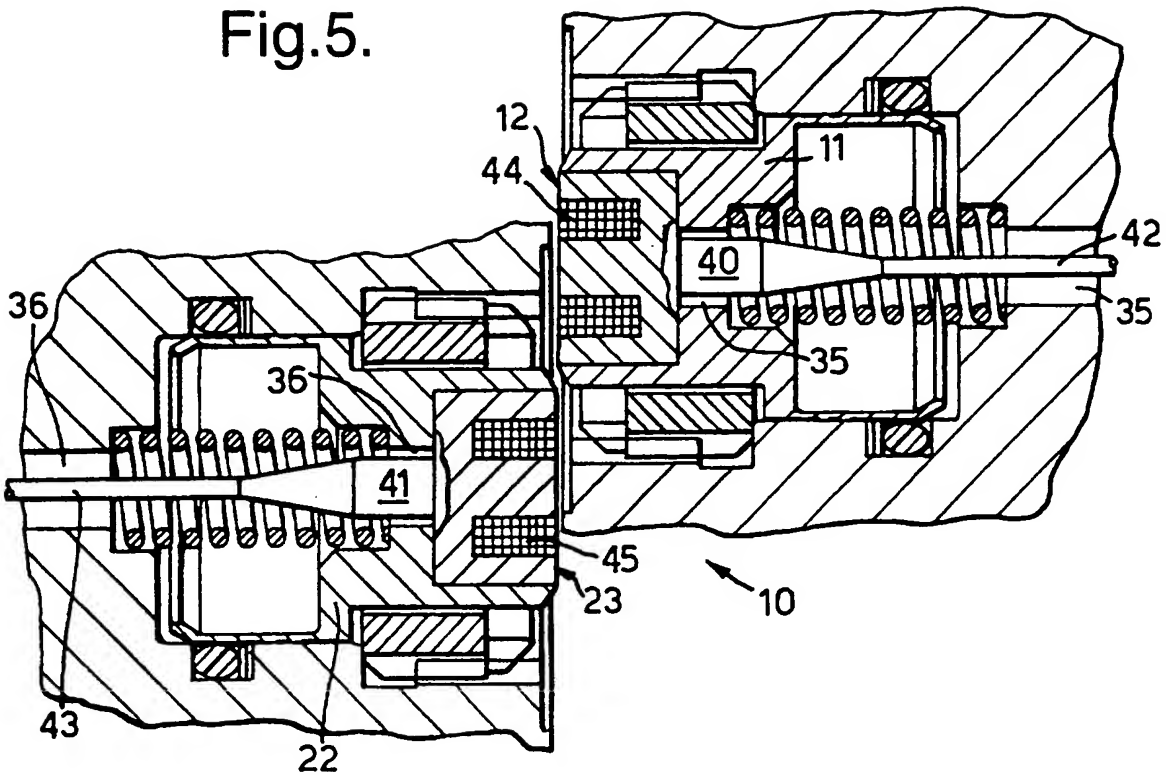
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Fig.6.

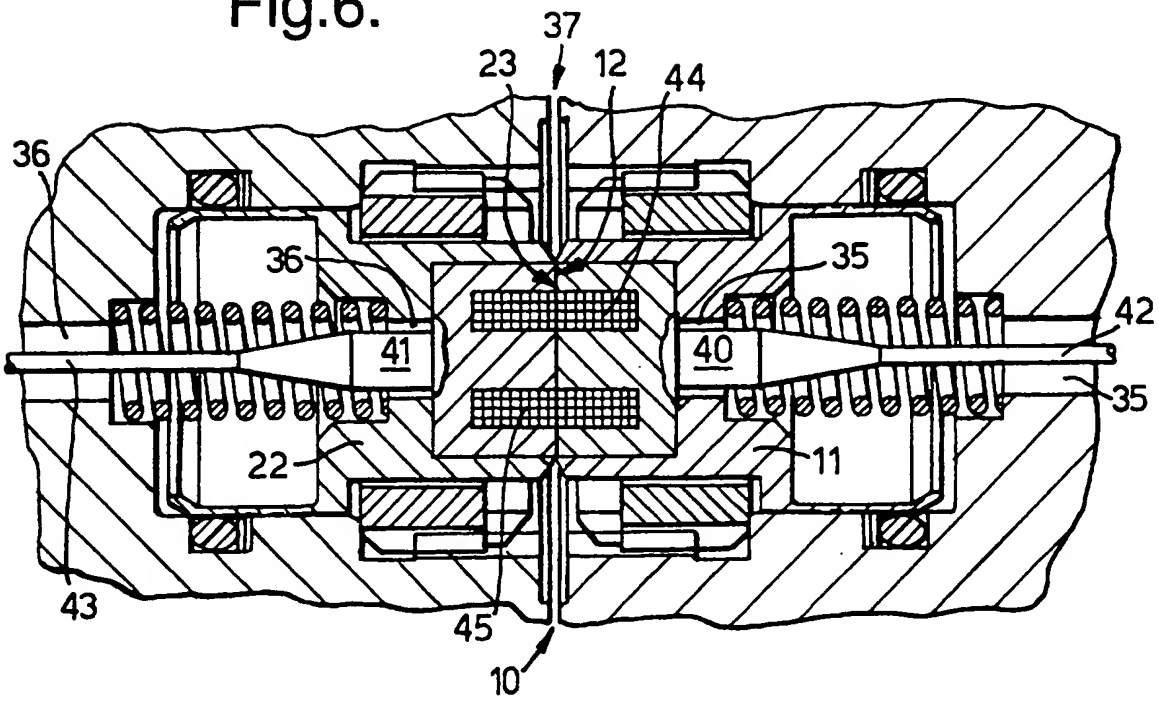
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Fig.7.

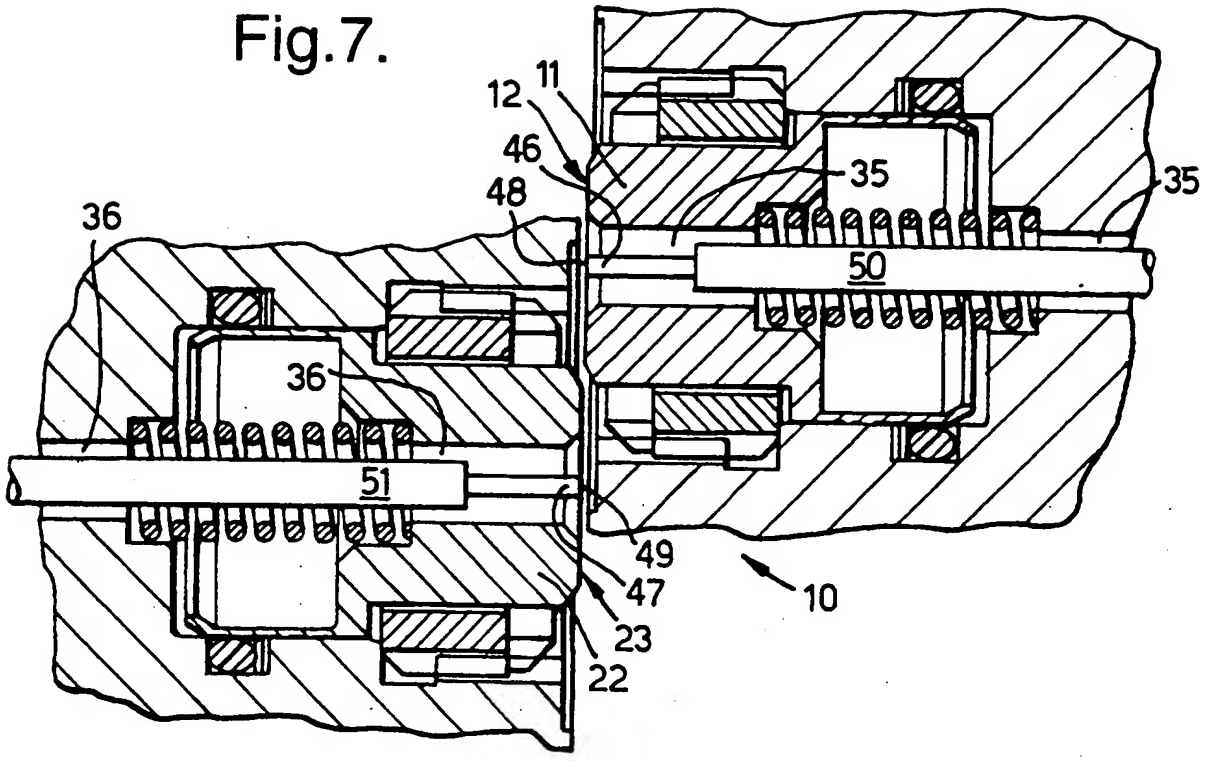
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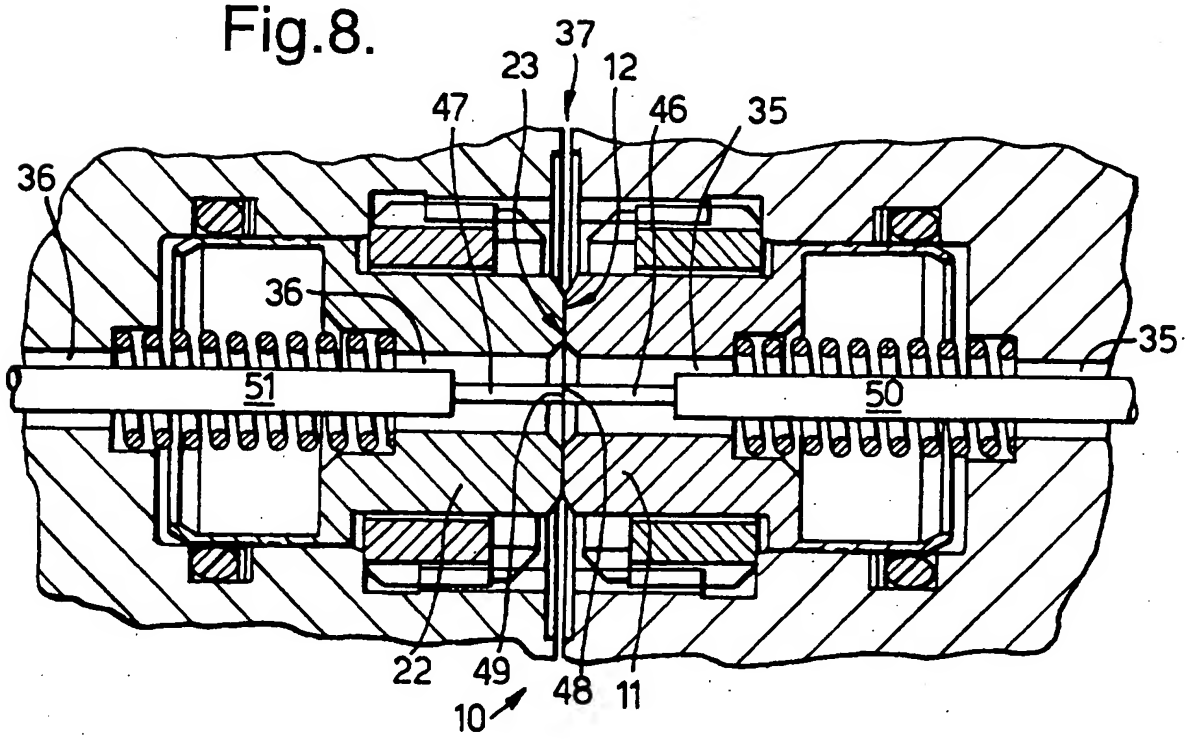
Fig.8.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TWO PART CONNECTOR

The invention relates to a two-part connector for use in harsh environments such as the ocean floor.

Two-part connectors are typically required in subsea oil applications for connecting electrical cable, fluid pressure lines and also fluid and electrical control lines.

Conventionally such two-part connectors are designed as plug and socket connectors and to ensure positive connection, the connectors are usually clamped tightly together. Due to the limited life of resilient seals under such harsh conditions, metal-to-metal seals are usually preferred but have to be of high precision. The engagement of high precision metal-to-metal seals is particularly difficult to the presence of water borne sediments and other contaminants which can become trapped between such metal-to-metal seals and cause leakage.

Two-part connectors are also useful in other harsh environments such as chemical plants and foundries, but these may also subject the connectors to air borne dust or grit which again can become trapped between the metal-to-metal seals and cause leakage.

It is an object of the present invention to provide a two-part connector which mitigates the problem of contaminants, such as sediment, dust or grit, becoming trapped between its sealing surface.

According to the invention a connector comprises a pair of pistons defining respective mating surfaces, one of the pistons being mounted within a bore in a first support member for movement along a first axis and arranged to engage a resilient seal mounted within the bore, the other piston being mounted within a bore in a second support member for movement along a second axis that is parallel to the first axis and arranged to engage a resilient seal mounted within the bore, the first and second support members being arranged for relative movement only in a direction at right angles to the two axes to enable the two axes to be aligned, means biasing the pistons towards each other such that their mating surfaces will wipe each other during alignment of the two axes, and a fluid connection means to admit pressurised fluid between each piston and its associated support member whereby the aligned pistons will press the mating surfaces together. In this manner the mating surfaces shear across each other thereby wiping off any contaminants as their axes are aligned, and the pistons ensure that the cleaned mating surfaces are held tightly together to prevent either the ingress of contaminants between them, or the leakage of any fluid if the two-part connector is used to connect fluid passageways.

Preferably the movement of the pistons towards each other is limited by respective flanges surrounding each piston which are arranged to abut respective retaining rings secured to each associated support member. This feature prevents the pistons from accidental ejection from their respective bores when their axes are out of alignment.

Each piston desirably has a skirt arranged to engage the resilient seal mounted within the bore of its respective support member. This skirt is preferably resiliently flexible

and is dimensioned relative to its associated bore such that the skirt will be deformed by the pressurised fluid to form a seal with the bore. This feature protects the resilient seal by closing the annular gap between the piston skirt and the associated bore. This protection is enhanced by positioning the resiliently flexible skirt to form the seal between its associated mating surface and its associated resilient seal. Ideally both the piston and its associated support member are formed from a corrosion resistant metal whereby the resilient seal is protected by a metal-to-metal seal created by the engagement of the expanded skirt of the metal position with the bore of the metal support member.

The two-part connectors taught by the present invention can be used to connect a wide range of fluid, electrical or optical lines.

In one embodiment a fluid passageway a fluid passageway may be formed through each mating surfaces such that the fluid passageways will be aligned when the two axes are aligned.

In another embodiment an optical fibre may be supported by each position and terminates at its associated mating surface to allow the optical fibres to be aligned when two piston axes are aligned.

In a further embodiment an electrical connection may be supported by each piston and terminates at its associated mating surface to allow the electrical connections to be aligned when the two axes are aligned.

The invention will now be described by way of example only, with reference to the accompanying drawings, in which:

Figure 1 is a transverse section through a two-part connector for pressurised fluid illustrating their disengaged position;

Figure 2 illustrates the engaged position of the two-part connector shown in Figure 1;

Figures 3 and 4 correspond with Figures 1 and 2 but illustrate a two-part connector for conductive electrical contacts;

Figures 5 and 6 also correspond with Figures 3 and 4 but illustrate a two-part connector for inductive electrical contacts, and

Figures 7 and 8 are also similar to Figures 1 and 2 but illustrate a two-part optical connector.

Figures 1 and 2 illustrate the construction of a two-part connector 10, of the type described in our co-pending British Application 9621768.2A, the whole contents of which is incorporate herein by reference. Figures 1 and 2 also illustrate the connector 10 in the disengaged position shown in Figure 1, and the engaged position as shown in Figure 2.

Referring to Figure 1, a first piston 11 defines a mating surface 12 at right angles to its

axis and a skirt 13 which is mounted within a bore 14 formed in a first support member 15 and engages a resilient seal 16 located in an annular groove 17 to form a seal. Movement of the piston 11 axially out of the bore 14 is limited by a stop comprising an external cylindrical flange 18 surrounding the piston 11 which is arranged to abut the inner end of a retaining ring 19 that is secured within the bore 14 by a threaded connection 20. A pre-loaded compression coil spring 21 reacts between the piston 11 and the first support member 15 to bias the piston 11 towards the left, as viewed in Figure 1 and 2, so that the flange 18 is held against the retaining ring 19 with the mating surface 12 projecting to its maximum from the bore 14.

Similarly a second piston 22 defines a mating surface 23 at right angles to its axis and a skirt 24 which is mounted within a bore 25 formed in a second support member 26 and engages a resilient seal 27 located in an annular groove 28 to form a seal. Movement of the piston 22 axially out of the bore 25 is limited by a stop comprising an external cylindrical flange 29 surrounding the piston 22 which is arranged to abut the inner end of a retaining ring 30 that is secured within the bore 25 by a threaded connection 31. A pre-loaded compression coil spring 32 reacts between the piston 22 and the second support member 22 to bias the piston 22 towards the right, as viewed in Figures 1 and 2, so that the flange 29, is held against the retaining ring 30 with the mating surface 23 projecting to its maximum from the bore 25.

From Figure 1 it will be noted that the mating surfaces 12 and 23 project slightly past each other by an amount which can be accommodated by respective bores 14 and 25.

The first support member 15 and the second support member 26 are arranged for relative movement only in a direction at right angles to the axes of their respective pistons 11 and 22. In this manner the pistons 11, 22 are moved from relative positions shown in Figure 1 to the positions shown in Figure 2 in which their axes are precisely aligned. During this movement chamfers 33 and 34 engage and serve to press both pistons 11, 12 slightly into their respective bores 14, 25 until the mating surfaces 12 and 23 are coplanar. The mating surfaces 12 and 23 are flat, scratch resistant and polished so that they wipe upon each other in a shearing manner to remove any particulate contamination.

After the mating surfaces 12 and 23 have been relatively moved to their fully engaged position, as shown in Figures 2, fluid pressure can be communicated between the lines 35 and 36. The fluid pressure acts on the effective areas of the pistons 11 and 22 to press their mating surfaces 12 and 23 firmly together to provide a primary metal-to-metal seal 37

The mating surfaces 12 and 23 can be manufactured from or coated with ceramic, crystal, glass or alike material such that the integrity of the primary metal-to-metal seal 37 is maintained during shearing engagements.

The resilient seals 16 and 27 provide secondary seals which are superseded by a secondary metal-to-metal seal as described in our co-pending British Application 9621768.2A, the whole contents of which is incorporated herein by reference.

The construction and operation of the two-part connector 10 illustrated in Figures 3 and 4 is identical to that already described with references to Figures 1 and 2 except that each piston 11 and 22 supports a respective electrical contact 38 and 39 via insulating sleeves 40 and 41, the electrical contacts 38 and 39 being conductively connected to respective electrical conductors 42 and 43. The contact 38 and 39, sleeves 40 and 41 and conductors 42 and 43 are positioned with clearance within the fluid lines 35 and 36. In this manner the fluid pressure is used as before to provide a primary metal-to-metal seal 37 between the mating surfaces 12 and 23 of the pistons 11 and 22 which also serve to align and interconnect the electrical contacts 38 and 39 as shown in Figure 4.

The two-part connector illustrated in Figures 5 and 6 is also an electrical connector and differs from that already described with reference to Figure 3 and 4 only so far as the electrical contacts 38 and 39 have been replaced by respective inductive couplings 44 and 45.

The construction and operation of the two-part connector illustrated in Figure 7 and 8 is identical to that already described with reference to Figures 1 and 2 except that each piston 11 and 22 supports a respective optical fibre. 46, 47 each having terminating polished ends 48 and 49, the optical fibre 46, 47 being sheathed, as indicated at 50 and 51. As before, the fluid pressure in the lines 35 and 36 is used to provide a primary metal-to-metal seal 37 between the mating surfaces 12, 22 of the pistons 12 and 23, and also to hold the polished ends 48 and 49 of the optical fibres 46 and 47 together in correct alignment.

CLAIMS

1. A connector comprising a pair of pistons defining respective mating surfaces, one of the pistons being mounted within a bore in a first support member for movement along the first axis and arranged to engage a resilient seal mounted within the bore, the other piston being mounted within a bore in a second support member for movement along a second axis that is parallel to the first axis and arranged to engage a resilient seal mounted within the bore, the first and second support members being arranged for relative movement only in a direction at right angles to the two axes to enable the two axes to be aligned, means biasing the pistons towards each other such that their mating surfaces will wipe each other during alignment of the two axes, and a fluid connection means to admit pressurised fluid between each piston and its associated support member whereby the aligned pistons will press the mating surfaces together.

2. A connector, according to Claim 1, in which movement of the pistons towards each other is limited by respective flanges surrounding each piston which are arranged to abut respective retaining rings secured to each associated support member.

3. A connector, according to Claims 1 or 2, in which each piston has a skirt arranged to engage the resilient seal mounted within the bore of its respective support member.

4 A connector, according to Claim 3, in which the skirt is resiliently flexible and is dimensioned relative to its associated bore such that the skirt will be deformed by the pressurised fluid to form a seal with the bore.

5. A connector, according to Claim 3, in which the resiliently flexible skirt is positioned to form the seal between its associated mating surface and its associated resilient seal.

6. A connector, according to any preceding claim, in which a fluid passageway is formed through each mating surface such that the fluid passageways will be aligned when the two axes are aligned.

7. A connector, according to any preceding claim, in which an optical fibre is supported by each piston and terminates at its associated mating surface to allow the optical fibres to be aligned when the two axes are aligned.

8. A connector, according to any of Claims 1 to 6, in which an electrical connection is supported by each piston and terminates at its associated mating surface to allow the electrical connections to be aligned when the two axes are aligned.

9. A connector substantially as described herein and as shown in any of the accompanying drawings.

Patent Office

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Application No: GB 9722058.6
Claims searched: 1-9

Examiner: Roger Binding
Date of search: 8 January 1998

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.P): F2G (G4F, G4K, G4Z, G23); H1T; H2E (EHE)

Int Cl (Ed.6): F16L 17/00, 21/00, 21/08, 25/00, 37/00, 37/56, 39/00; H01F 38/14; H01R

Other:

Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
A	GB 2132728 A (NL INDUSTRIES), see Fig 7 and page 5, line 103, to page 6, line 44.	1

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.